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CLARIFYING AN AMBIGUOUS FUNCTIONAL ANALYSIS WITH MATCHED AND MISMATCHED EXTINCTION PROCEDURES

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Results of a functional analysis were ambiguous in suggesting that self-injurious behavior (SIB) was maintained by escape, sensory reinforcement, or both. To help clarify these results, we compared escape extinction, sensory extinction, and the combined treatments. Sensory extinction proved to be a necessary and sufficient treatment, whereas escape extinction failed to decrease SIB. These analyses helped to clarify the function of SIB and to identify an effective and efficient treatment.

DESCRIPTORS: extinction, functional analysis, self-injurious behavior

Results of functional analysis sometimes suggest that self-injurious behavior (SIB) is maintained by multiple sources of reinforcement. However, hypotheses about multiple control are not always accurate. One method that has been used to validate results that suggest a single function involves the application of both a matched treatment (i.e., based on the hypothesized function) and a mismatched treatment (i.e., unrelated to the hypothesized function; Iwata, Pace, Cowdery, & Miltenberger, 1994). If the matched treatment is clearly more effective than the mismatched treatment, the validity of the functional analysis is supported.

An analogous method can be applied to the results of analyses that suggest multiple operant functions for SIB (Smith, Iwata, Vollmer, & Zarcone, 1993). This is accomplished by imposing both matched and mismatched treatments on the various baselines corresponding to the hypothesized functions (e.g., when an analysis implicates both attention and automatic reinforcement, treatments for each of these functions are imposed on both the attention and alone baselines). Smith et al. employed this method after the results of functional analyses conducted with 3 participants suggested that SIB had multiple functions. Treatment analyses confirmed the multiple-control hypotheses for 2 participants, in that only matched treatments reduced SIB when compared to baseline conditions for those functions. For a 3rd participant, a treatment (enriched environment) that addressed only one function (automatic reinforcement) reduced SIB in both the alone and attention conditions. The authors concluded that this treatment analysis disconfirmed the multiple-control hypothesis.

This method of validating functional analysis results (i.e., applying matched and mismatched extinction procedures) might also be useful for choosing between a small number of alternative hypotheses when the results of a functional analysis are ambiguous. In this study, a functional analysis suggested that automatic reinforcement, escape, or both maintained the participant's SIB. We tested these three alternative hypotheses by

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comparing the efficacy of sensory extinction (SE; a treatment for automatically maintained behavior), escape extinction (EE; a treatment for escape-maintained behavior), and the combination of these two interventions relative to a demand baseline.

METHOD

Jay was a 35-year-old man who had been diagnosed with autism, obsessive compulsive disorder, and severe mental retardation and who had been admitted to an inpatient unit for the assessment and treatment of severe face hitting and head banging. Jay was ambulatory and could follow simple one-step instructions, but had very limited communication skills. All functional analysis and treatment sessions were 10 min in duration, and were conducted in a room (3 m by 3 m) equipped with a one-way mirror, behind which trained observers recorded target responses on laptop computers. Interobserver agreement was assessed during 58.7% of the sessions and exact agreement coefficients averaged 94.4% (range, 68.9% to 100%).

A functional analysis was conducted using procedures similar to those described by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994). Four analogue conditions were included: demand, attention, play, and ignore. Due to the severity of Jay's SIB, we attempted to block SIB throughout the study. Therefore, an ignore condition was substituted for the alone condition. During ignore, the therapist attempted to block SIB and ignored all other responses. The programmed social contingencies (e.g., escape in demand) were implemented for both attempted and completed SIB. However, Jay's SIB occurred very quickly, and a substantial proportion of his attempts resulted in hand-to-face contact (38.5% in a sample of three videotaped EE sessions), representing an intermittent schedule if it was maintained by automatic reinforcement. Prior to the treatment analysis, two probes were conducted to gauge the effects of a helmet equipped with a clear plastic face shield. These probes were identical to the demand sessions of the functional analysis, with the exception that Jay wore the helmet and the sessions lasted 30 min each. Subsequent treatment analyses were conducted in the two functional analysis conditions that produced the highest rates of SIB. In an ignore analysis, SE, through the use of the face shield, was compared to an ignore condition without the helmet in an ABAB reversal design. In addition, we compared the effects of SE, EE, and the combination of these two treatments in the demand condition. These treatments were compared to each other in a multielement design, and to a demand baseline (using the functional analysis data as the initial phase) in an ABAB reversal design. All conditions were identical to the demand baseline with the following exceptions. During SE, Jay wore the helmet with face shield and continued to receive a 30-s escape contingent on SIB. During EE, Jay did not wear the helmet, and the prompting sequence continued independent of SIB. During SE+EE, Jay wore the helmet and SIB did not result in escape from demands.

RESULTS AND DISCUSSION

Figure 1 shows the results of all analyses. During the functional analysis, Jay displayed higher rates of SIB in demand (M = 3.7 responses per minute) and ignore (M = 3.8) conditions relative to play (M = 0.9) and attention (M = 1.2) conditions. During the two helmet probes, Jay engaged in more SIB during the initial portions of the 30-min sessions than during the later portions, suggesting that SIB ceased to occur due to responding without reinforcement (i.e., extinction). In the ignore analysis, SIB decreased from a mean of 3.1 responses per minute during baseline to 0 during SE. In the demand analysis, high rates

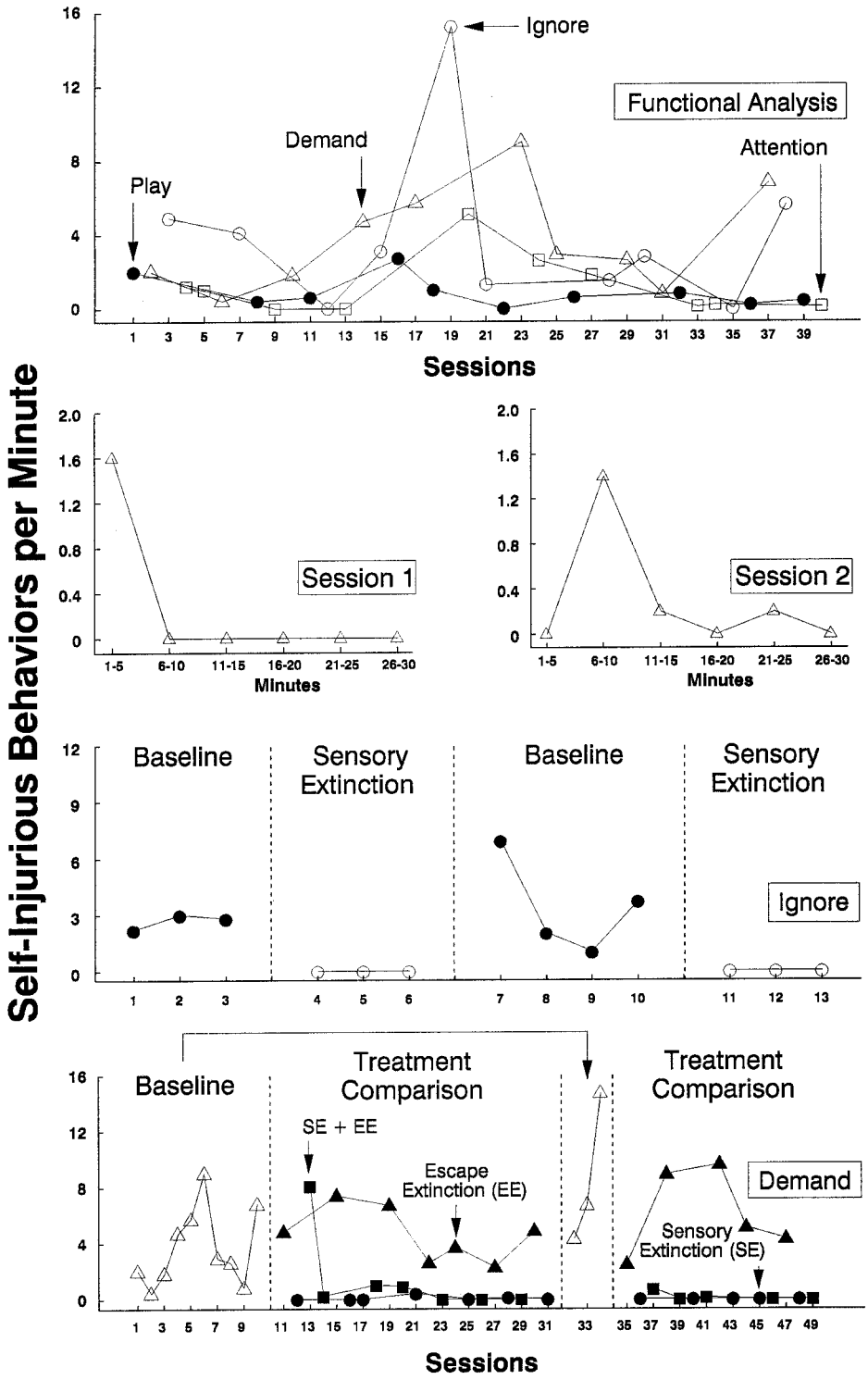

Figure 1. SIB per minute during (a) the attention, demand, ignore, and toy play conditions of the functional analysis (top panel); (b) the helmet probes (second panel); (c) the ignore baseline and SE (third panel); and (d) the demand baseline, EE, SE, and the combination of these two treatments (SE+EE; bottom panel).

of SIB were observed during baseline (M = 5.0). During the treatment, near-zero rates of SIB occurred during SE (M = 0.04) and SE+EE (M = 0.9), but remained high in EE (M = 5.2).

The functional analysis results for Jay suggested that his SIB was maintained by automatic reinforcement, escape from demands, or both. Although we held blocking constant across all functional analysis conditions, differential responding still occurred, despite the intermittent attention Jay received through blocking (a potential source of reinforcement). When we implemented SE+EE during demand conditions, the rates of SIB fell dramatically relative to baseline. When each of these extinction components was implemented separately, rates of SIB decreased with SE but not EE. Finally, SE also reduced rates of SIB relative to an ignore baseline. SE was the only treatment component that was common to all instances of decreased SIB. These results suggest that (a) Jay's SIB may have been maintained primarily by sensory reinforcement and not escape from demands; (b) SE was a necessary and sufficient treatment; and (c) it may be more efficient to use treatment analyses to clarify ambiguous functional analyses because, if successful, behavior reduction is obtained sooner than with additional, extended functional analysis.

The results of EE in our analysis are similar to those observed by Iwata et al. (1994) when this same treatment was applied to head banging that appeared to be maintained by automatic reinforcement. In that study, EE did not reduce the participant's SIB in the demand condition, whereas SE, with a helmet, substantially reduced SIB in all functional analysis conditions. However, unlike Jay, the participant in their study did not show elevated rates of SIB in the demand baseline.

Why, then, did Jay's functional analysis suggest the possibility of a negative reinforcement function? One explanation is that automatically reinforced behavior may be more likely to occur in demand, relative to attention or play, because of periods in which few external sources of stimulation are available. That is, when escape occurs in the demand condition, there is a portion of session time during which the automatically reinforced behavior is more likely to occur due to the lack of stimulating alternatives. Within-session analyses of the functional analysis demand sessions revealed that the rates of Jay's SIB were over three times as high during the escape intervals than during demands. By contrast, in the attention and play conditions, leisure items are freely available throughout the session and may have competed with automatically reinforced behavior. An alternative explanation is that the functional analysis was accurate, but that hand-to-helmet contact functioned as punishment and overrode the reinforcement produced by SIB. In addition, if Jay's SIB was in fact sensitive to escape, it is possible that SIB may have decreased given a more extended evaluation of EE. Future studies might further explore automatic punishment versus extinction effects with protective equipment (e.g., by padding the outside of the helmet).

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